Claims

1. A method for recovering molybdenum comprising the steps of:

1) dispersing a molybdenum-containing material which contains at least molybdenum, A element (phosphorus and/or arsenic) and X element (at least one selected from the group consisting of potassium, rubidium, cesium and thallium) in water and adding alkali to make pH of the resultant mixed liquid 8 or more;

2) adjusting pH of the resultant mixed liquid to fall within the range of from 6 to 12 followed by adding a compound containing magnesium and aqueous ammonia to form a precipitate containing at least magnesium and A element; and

3) separating the precipitate containing at least magnesium and A element formed in the step 2) from a solution containing at least molybdenum (recovered molybdenum-containing liquid).

2. The method for recovering molybdenum according to claim 1, further comprising the step of:

4) forming a precipitate containing at least molybdenum by adjusting the pH of the recovered molybdenum-containing liquid to 3 or less and separating the precipitate thus formed (recovered molybdenum-containing precipitate) from the solution .

3. The method for recovering molybdenum according to claim 1 or 2, wherein a molybdenum-containing material which contains at least molybdenum, A element (phosphorus and/or arsenic) and X element (at least one selected from the group consisting of potassium, rubidium, cesium and thallium) is a catalyst for use in producing methacrylic acid through gas-phase catalytic oxidation of methacrolein having a composition represented by the following formula (1):

$$A_a Mo_b Y_c X_d O_e \qquad (1)$$

wherein Mo and O represent molybdenum and oxygen, respectively; A

represents phosphorus and/or arsenic; Y represents at least one element selected from the group consisting of iron, cobalt, nickel, copper, zinc, magnesium, calcium, strontium, barium, titanium, vanadium, chromium, tungsten, manganese, silver, boron, silicon, aluminum, gallium, germanium, tin, lead, antimony, bismuth, niobium, tantalum, zirconium, indium, sulfur, selenium, tellurium, lanthanum and cerium; X represents at least one element selected from the group consisting of potassium, rubidium, cesium and thallium; and subscripts a, b, c, d, and e represent an atomic ratio of each element, respectively; when b is 12, a is in the range of from 0.1 to 3, c is in the range of from 0 to 3 and d is in the range of from 0.01 to 3 and e represents the atomic ratio of oxygen necessary for fulfilling the requirement of the valence of each element above.

4. A method for producing a catalyst by using a recovered molybdenum-containing liquid and/or a recovered molybdenum-containing precipitate (expressed altogether as "recovered molybdenum-containing material") which has been recovered by using the method according to any one of claims 1 to 3.

5. The method for producing a catalyst according to claim 4, wherein the catalyst is produced by using a raw material of molybdenum other than the recovered molybdenum-containing material together with the recovered molybdenum-containing material.

6. The method for producing a catalyst according to claim 4 or 5, wherein 1 to 17 moles of ammonia per 12 atoms of molybdenum is included when the catalyst is produced.

7. The method for producing a catalyst according to any one of claims 4 to 6, wherein temperature of solution or slurry in the entire steps or a part of the steps in the production of catalyst is 0 to 40°C lower than that in the case where a raw material of molybdenum other than the recovered molybdenum-containing

material which has been recovered by using the method according to any one of claims 1 to 3 is used.

8. The method for producing a catalyst according to any one of claims 4 to 7, wherein the catalyst has a composition represented by the following formula (1):

$$A_a Mo_b Y_c X_d O_e \qquad (1)$$

wherein Mo and O represent molybdenum and oxygen, respectively; A represents phosphorus and/or arsenic; Y represents at least one element selected from the group consisting of iron, cobalt, nickel, copper, zinc, magnesium, calcium, strontium, barium, titanium, vanadium, chromium, tungsten, manganese, silver, boron, silicon, aluminum, gallium, germanium, tin, lead, antimony, bismuth, niobium, tantalum, zirconium, indium, sulfur, selenium, tellurium, lanthanum and cerium; X represents at least one element selected from the group consisting of potassium, rubidium, cesium and thallium; and subscripts a, b, c, d, and e represent an atomic ratio of each element, respectively; when b is 12, a is in the range of from 0.1 to 3, c is in the range of from 0 to 3 and d is in the range of from 0.01 to 3 and e represents the atomic ratio of oxygen necessary for fulfilling the requirement of the valence of each element above.